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MAY, 1911 BULLETIN 296

CORNELL UNIVERSTY

AGRICULTURAL EXPERIMENT STATION OF

THE COLLEGE OF AGRICULTURE

Departments of Plant Pathology and Pomology

SPRAYING FOR BLACK ROT OF THE GRAPE IN A DRY SEASON

IMPERIAL BUREAU 13 JUL 1921 OF MYCOLOGY

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ITHACA N. Y.
PUBLISHED BY THE UNIVERSITY

ORGANIZATION

Of the Cornell University Agricultural Experiment Station.

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SPRAYING FOR BLACK ROT OF THE GRAPE IN A DRY SEASON

EXPERIMENTAL WORK IN CONTROL OF BLACK ROT OF GRAPES IN 1909

DONALD REDDICK and C. S. WILSON

The experimental plats for the year 1909 were located, as stated in Bulletin 266, in the Cushman Vineyard at Romulus, the vineyard from which, because of Black Rot and Mildew, no grapes had been picked for many years. The illustration (Fig. 202) conveys some idea of the rundown condition of this vineyard. The fruit of the previous summer had been destroyed by the Mildew and the Black Rot, and the vines defoliated by the Mildew. In consequence of this severe infection of Mildew, more wood than normal had to be pruned away, because it did not mature and was quickly frozen with the advent of cold weather. Often only one or two living buds could be found on a cane. This condition is well shown in Fig. 203, a photograph taken on the same date as that in Fig. 202, but in the year 1909.

FIG. 202.—*Shows the average condition of the vines in 1908 in that part of the vineyard chosen for experimental work in 1909. Foliage destroyed by the Mildew (Plasmopara) and the fruit by Black Rot (guignardia). Compare with Fig. 203, a photograph made in the same plat on the same day of the succeeding year. Photo. Sept. 9, 1908.*

The plats were located to secure the worst conditions possible. They were on a gentle slope to the east and toward the

lake. The soil was a light clay to gravelly loam and was very uniform. As the vineyard had been neglected for several years the entire surface of the ground was covered with a fairly dense sod. The vines, as far as growth and health were concerned, seemed to be fairly uniform. The yield and the number of missing vines, as discovered later, showed that this was not the case.

It so happened that eleven rows made just an acre. Accordingly, acre plats of eleven rows each were laid out. One row was left between each two plats, as indicated in the chart, Fig. 204.

FIG. 203.—*Shows average condition of vines in the experimental plat of 1909. Fruit and foliage healthy. Yield light because of the small number of buds which survived the winter. Compare with Fig. 202, a photograph made in the same plat on the same day of the preceding year. Photo. Sept. 9, 1909.*

The plats were plowed early in June. Because of the sod this was difficult, but by using a chain the sod was completely turned over and the old mummies of the preceding year buried. This included the mummies adhering to the canes for in pruning the men had removed all such clusters. Following the plow, the disk harrow was used to break up the sod, and later the entire vineyard was gone over twice with a spring-tooth harrow.

The management of the experimental plat was entirely in the hands of representatives of the College, and, consequently, we were able to do just the work we wished and at the proper time. As in former years, a field laboratory was maintained on the vineyard, and as both of the authors were forced to be absent for a part of the time the work was placed in the charge of Mr. C. N. Jensen, who took all records and kept all data. Mr. Jensen rendered valuable and efficient service in this work during the summer.

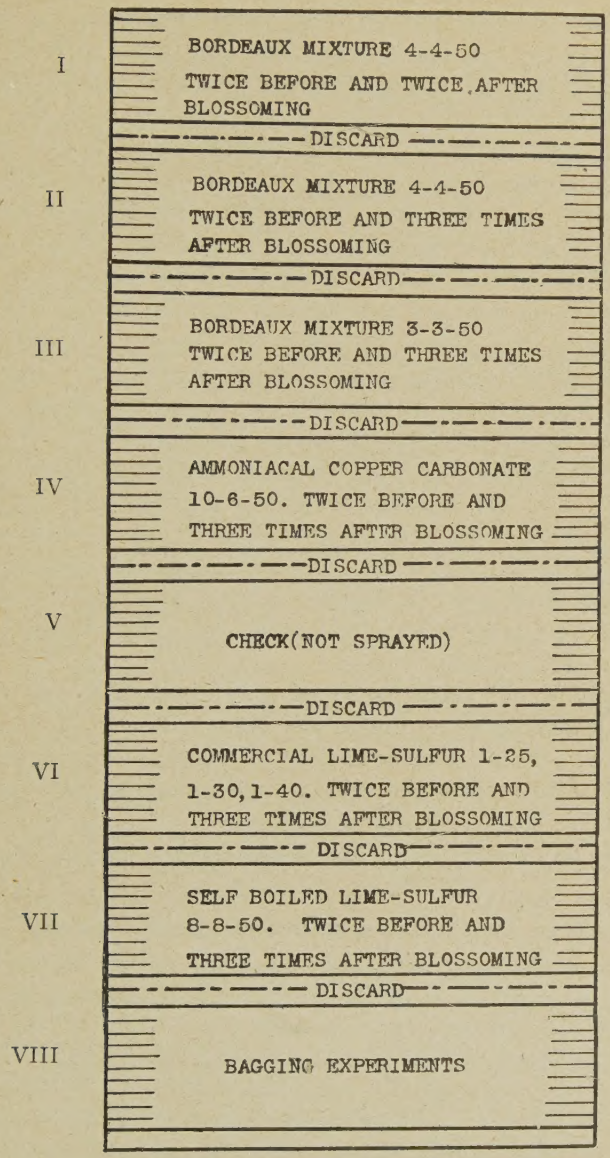

FIG. 204.—*Chart of the experimental plats of* 1909. *Eleven rows in each plat, forty-five vines in the row. Section VI., Cushman Vineyard, Romulus, N. Y.*

The plan for the spraying was to keep all new growth covered, as we had found in previous years that this was essential to the successful control of the disease. Following each rain there appeared to be a

period of more active growth of vine, when new leaves pushed out rapidly. This growth became less and less, and after a period of dry weather, when elongation and enlargement practically ceased, the spray was applied. Particular effort, however, was made to have this application precede a rain. This was possible in most cases from a study of the daily weather maps, which were received from the nearest recording station and from which we were able to follow the storm centers quite accurately. It is necessary to spray before a rain only in cases in which the new growth is exposed and not covered with the spray. This growth may be in length of stem, or new leaf, or increase in size of leaf and berry, exposing a new area. The effect of showers followed by sunshine or brisk wind is practically nil. Such a shower is not of sufficient duration to permit of spore germination and has practically no effect on the growth of the vine. Thus the spray of June 16th was effective against the very general infection which occurred June 22nd and 23rd. On the other hand the showers of July 3rd, 11th, 12th, 15th, 16th, 18th, 22nd, 23rd and 24th were of such short duration or were accompanied by winds which dried up the water so quickly that practically no infection occurred, even on unsprayed areas, and this in spite of the fact that there were many spots on the leaves and lesions on the peduncles and pedicles of the clusters.

These points would seem to be of great importance to the vineyardist. He cannot hope to obtain the best results from his spraying unless he follows the weather conditions as related to the growth of the vine, and unless he realizes the value of the foregoing facts concerning the habits of the fungus causing the disease.

Considering the above points, the following applications were made in 1909:

DATE OF SPRAYING EXPERIMENTAL PLATS IN 1909

Cushman Vineyard, Romulus, N. Y.

I	II	III	IV	V	VI	VII	VIII
Bordeaux 4-4-50	Bordeaux 4-4-50	Bordeaux 3-3-50	Am. cop. car. 6-10-50	Check	Heavy grade Niagara lime-sulfur	Self-boiled lime-sulfur 8-8-50	Bagging
June 4	June 4	June 4	June 3	.....	June 7, 1-25	June 3	.....
June 16	June 16	June 16	June 16	.....	June 16*	June 16	.....
June 28	June 28	June 28	June 28	.....	June 28, 1-30	June 28	.....
July 6	July 5	July 5	July 5	.....	July 5, 1-30	July 5	.....
.....	July 21	July 21	July 21	.....	July 29, 1-40	July 21	.....

Plat I was to receive no more than four applications. It was planned to spray Plats II and III late in the season with ammoniacal copper carbonate, but this

was deemed unnecessary because of weather conditions and the state of the fungus at that time.

*Plat VI received an application of self-boiled lime-sulfur June 16. The other applications on Plat VI were with Niagara lime-sulfur as follows: First application, June 7, 1–25; June 28, 1–30; July 5, 1–30 (1½ rows on west not sprayed); July 29, 1–40.

Plat VII received an application of commercial lime-sulfur on June 16, diluted 1–25, and on July 21 the three rows on the west side of the plat were not sprayed.

Plat VIII, the bagging experiment, was not sprayed at all. Two rows on the west side were bagged July 1; the next two rows were bagged July 5, and the next two July 10.

The heaviest infection of the season, as in the two previous years, occurred on June 22nd. This, of course, is only a coincidence. An important difference, however, is to be noted, which in our estimation meant half the crop. In previous years the vines had been in bloom on this date. In this particular year practically no vines were in bloom. Leaf infections from the rain of May 28th were abundant and spores were present. Consequently, many infections occurred at this time on the shoots, leaves, peduncles, and tendrils, but the fruit was protected by the calyx, which fell off two to four days later. An infection of this kind, though not serious on the fruit, has its bearing on next year's crop. The fungus is known to winter over on the parts of the vine above mentioned, and thus sufficient opportunity is afforded for an epidemic of Black Rot the following year, provided the weather conditions are favorable.

An examination of a few rotting berries found July 14th (infected June 22nd or 23rd), on canes lying on the ground, showed that the fungus was already preparing for winter. Nearly half of the fruiting bodies of the fungus formed on the rotted berries were pycnosclerotia or spermogonia. On July 25th, an examination of berries rotted from a light infection of July 3rd showed that the winter stage had developed exclusively, or practically so. On the strength of this observation and of similar observations of the previous year, spraying in the experimental plat was discontinued. There was some apprehension that pycnospores in pycnidia on peduncles might prove a source of infection, but examination showed most of these to have voided their spores. Later developments justified this action.

The time of the application of the sprays was governed by the weather conditions, the growth of the vine, and the development of the fruit. The mixture was applied by a traction outfit and the spray directed by hand, as described and illustrated in previous bulletins. Former experiments had shown that bordeaux mixture, 4–4–50, controlled the disease

effectively. Plat III was designed to test the efficiency of a weaker solution. It was planned to spray Plat IV with ammoniacal copper carbonate, 5–3–50, but when this mixture is compared with bordeaux with respect to the amount of effective copper, it seems to be only about one-half as "strong." Accordingly, the amounts of ammonia and copper carbonate in the above formula were doubled. At this strength considerable burning resulted. The vines appeared darker, but did not turn brown, and the fact that they had been burned was not discovered until after the fourth application, when the burning effect of the spray was quite evident. For the last application of ammoniacal copper carbonate the strength was materially reduced, seven ounces of carbonate and a proportionate amount of ammonia being used. Even at this reduced strength some burning resulted.

By an unfortunate accident the applications of July 16th on Plats VI and VII were interchanged. The final result seems not to have been materially affected. The first two applications on Plat VI of the heavy grade Niagara brand lime-sulfur were made at a dilution of 1–25. Shortly after the second application it became apparent that the leaves were severely injured by the application, although the fruit escaped. The leaves were checked in their growth, became brown and crimped about the margin, and for this reason the whole plat stood out prominently. The next two applications were made at a dilution of 1–30. Even at this dilution there was some injury, so that the last application was made at a dilution of 1–45. There was no apparent injury at this strength*, but on the other hand there was no opportunity to test the value of this dilution as a fungicide.

The self-boiled lime-sulfur was made according to Scott's formula, 8 pounds of each of the ingredients being used to 50 gallons of water. With good lime, which we obtained from Ohio, the mixture is conveniently made, is easily kept in suspension, and is readily applied. Approximately 60 to 65 gallons per acre were applied in the case of all the fungicides.

The clusters of Plat VIII were bagged, but the plat was not sprayed. Two rows were bagged July 1st, i. e., as soon as the berries were set. Because of the unusually high winds of that season many of the clusters were broken off entirely. The next two rows were bagged July 5th, at a time when the peduncles had become a little stronger. The next two rows were bagged July 10th. In all cases bagging proved a failure as a method of controlling the Black Rot, a fact which is not surprising. On

* The reader's attention is called to further trials with lime-sulfur solution recorded on page 587.

June 22nd, infection occurred quite generally and very many peduncles and pedicles had lesions of the Black Rot on them. Hence, with each shower which occurred during the summer drops of water ran down the peduncle, causing an exudation of spores, which in turn were washed to the berries. The bag served as a protection from sun and wind, and consequently more infections actually took place on the clusters in the bags than on those in the open.

The plats were picked October 14th and the grapes taken to the packing house, where the results were carefully computed. The following table summarizes the season's work:

EXPERIMENTAL PLATS.*

	Gross weight of fruit	No. of boxes	Net weight†	Net weight of first-class fruit	Net weight of wine grapes	Net weight of culls ‡	No. of rotten berries
Plat I.....	3478	138	2604	1874	598	98	494
Plat II.....	4532	178	3404	2536	730	118	.....
Plat III.....	5086	206	3782	2932	646	106	298
Plat IV.....	2800	120	2040	1304	648	48	176
Plat V.....	2560	104	1910	1228	692	42	6572
Plat VI.....	2752	102	2162	1024	862	50	738
Plat VII.....	3252	120	2564	1600	834	70	570
Plat VIII.....	2868	124	2112	1364	598	62	6982
Rows not sprayed.....	2280	86	1734	1010	672	46	.....
Total	29608	1178	22312	14872	6280	640	.....

In order to determine the actual loss of fruit, one thousand perfect berries were weighed and the average weight of a single berry computed. Knowing the number of rotten berries per plat, the loss in terms of fresh fruit was easily computed. This does not represent exactly the true state of affairs, however, since a few rotten berries in a cluster made that cluster unmarketable as first-grade fruit. The actual difference between the sprayed and the unsprayed plats approximated thirty-eight to forty pounds of fruit, which at prevailing prices would no more than pay for one application of the mixture.

* The number of missing vines in the various plats is as follows: Plat I, 85; II, 63; III, 33; IV, 45; V, 41; VI, 48; VII, 60.

† The net weight as given in this column should equal the sum of the net weight of first-class fruit plus net weight of wine grapes plus net weight of culls as given in the next three columns. The figures in the next three columns, however, represent actual weights after grading. Some shrinkage must necessarily occur, which accounts for the fact that the sum of these three net weights is slightly less than the total net weight.

‡ Culls include crushed fruit only, not rotten.

The fruit was marketed through the Niagara Grape Market Company. One-half the fruit from the total area, which according to the contract was the share of the College, brought in total receipts of $252.49. At the same rate all of the fruit would have brought in total receipts of $504.98. The total expense for the entire area was $284.92, leaving a net income of $220.06 for the nine acres, or about $24 per acre.

The net income per acre would have been greater had no spraying been done, but in general we feel that money spent in spraying is well spent. The greatest value of the spraying lies in the fact that the canes of these vines went into the winter practically free from Black Rot lesions. Those of the unsprayed vines had abundant lesions on them which served as infection sources in the spring of 1910. We are of the opinion that sufficient sources of infection were present in unsprayed areas to precipitate an epidemic of the disease in 1910, provided the weather conditions had been favorable.

In fact, the spraying in 1909 we regard as extremely important to any one who has had Black Rot in the past and in whose vineyard occasional rotten berries can be found. By spraying in such a year it will be possible to eliminate the disease, or at least to reduce it to such an extent as to make control possible in an epidemic year, which is likely to follow.

The experiment with Mildew proved a total failure, since we were unable to find a single lesion of the *Plasmopara* in any part of the plats, nor even in uncultivated and untrimmed parts of the vineyard. The total absence of this parasite is unexplainable. No oospores could be found in 1908, though diligent search was made for them. They may not have been formed. On the other hand, if they were formed, they may not have had opportunity to germinate. First appearances of Mildew are usually in July, so presumably the first infections come relatively late. If this is true, the exceptionally dry weather and unfavorable conditions generally, by preventing oospore germination, may account for the absence of the *Plasmopara*.

The work of the summer was unsatisfactory from the point of view of the experimenter, though favorable to the grower. A few of the more important findings may be stated as follows:

Some data were accumulated in regard to the strength of lime-sulfur for fungicidal purposes.

When so used the ammoniacal copper carbonate cannot be used stronger than the usual formula because of burning.

Bordeaux mixture of the 4–4–50 formula again seems sufficiently "strong" for controlling the disease, and there are indications that the 3–3–50 formula may also prove effective.

The spraying of grapes for Black Rot in 1909 was not profitable so far as the immediate financial returns were concerned, but as a means of reducing the amount of rot in another year we regard it as decidedly profitable.

Perhaps the most important message to the grower is again to call attention to the fact that the Black Rot disease, according to past history, is one that comes in waves. The mere fact that we have had three years of comparative immunity means that the time for the next epidemic is nearer at hand. There is not the slightest doubt that if a rainy season comes in 1910 we shall have an epidemic of Black Rot. If the season is dry, it will still be important to spray in 1910 to completely eradicate the disease. It therefore seems wise to repeat the recommendation of former bulletins on this subject, with such slight changes as experience permits. See page 588.

EXPERIMENTAL WORK IN CONTROL OF BLACK ROT OF GRAPES IN 1910

DONALD REDDICK AND CHAS. T. GREGORY

The experimental plats for 1910 were located, as in former years, in the Cushman vineyard at Romulus, N. Y., the only difference being that this year they were in a section which was not sprayed in 1909. The variety was the same (Niagara), the soil approximately the same, and the plats were of the same size. The spray mixtures were slightly changed, as can be seen from the chart (Fig. 205).

There were eight plats having seven rows each, sixty-eight vines long, thus giving exactly one acre to each plat. Between the plats were discard rows to prevent the different sprays blowing to the adjacent plats. In all there were nine acres in the experimental vineyard.

The plats were arranged as shown in the chart on page 583, and received different treatments as indicated.

Plats I to III inclusive, all on single wires, were designed to test the effectiveness of the various applications of a spray which has previously been shown to be effective in controlling Black Rot infections. The remaining plats were designed to test relative values of the various substances mentioned.

During the spring there was considerable rain and conditions seemed favorable for a Black Rot year. But, in general, these rains occurred before the ascospores of the fungus had matured, and thus few infections occurred until the latter part of the rainy period. The rains during the summer were not of sufficient frequency or duration to cause any great amount of new infection.

All the plats except No. II were first sprayed on June 3rd. At this time the lime-sulfur was applied on Plat IV at the rate of 1 gallon of lime-sulfur in 50 gallons of water. The other plats were sprayed as shown in the chart. The first three, and in some cases four, leaves had unfolded. As the shoots were very small it was possible to spray 2 acres with the 65 gallons which the spray tank held.

The spray machine was a Brown traction sprayer with a 65-gallon tank, a small compression chamber and two double-action pumps, with which it was easy to hold a pressure of 125–150 pounds. The spraying was done by two men with trailers, because in this way the vines were more thoroughly and effectively covered and the spray was not wasted to such an extent as with the stationary nozzles.

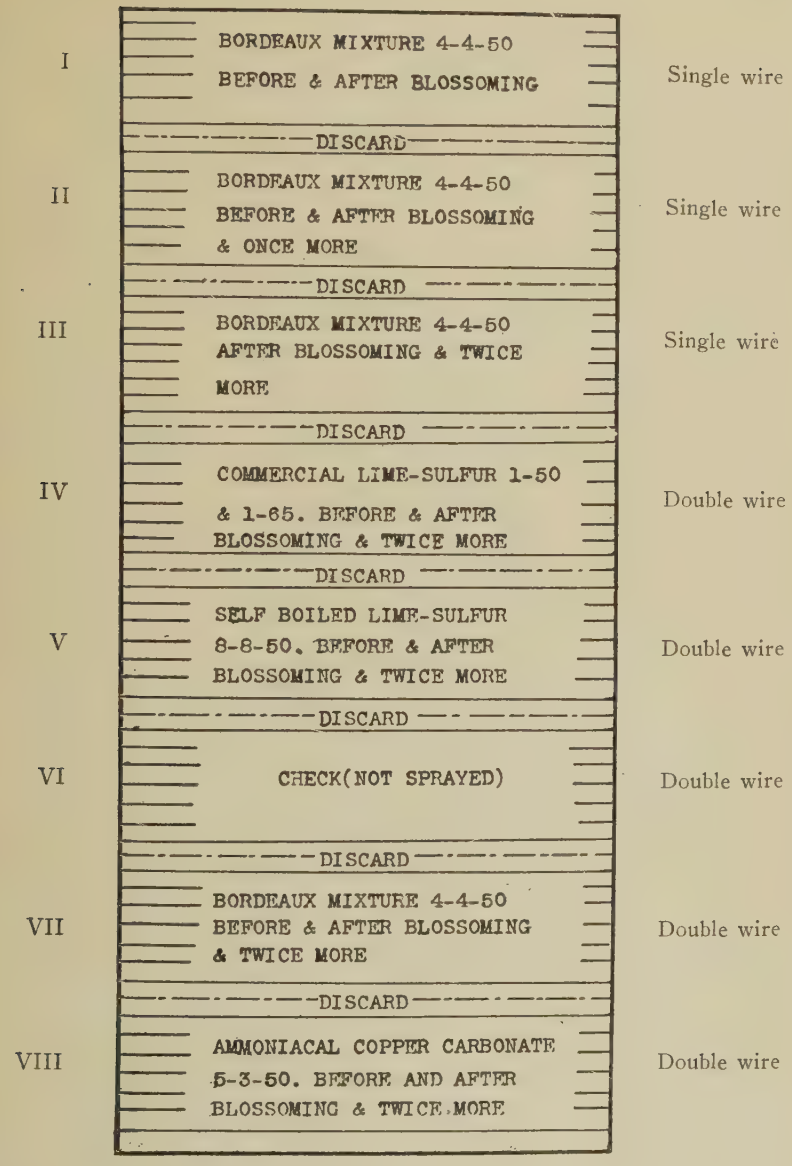

FIG. 205.—*Chart of the experimental plats of* 1910. *Seven rows in each plat, sixty-five vines in the row. Section VII., Cushman Vineyard, Romulus, N. Y.*

We anticipated some leaf infection on all of the experimental plats because of the frequent and continuous rains late in May. On June 14th the first leaf spots were noted. New ones appeared from day to

day until they were quite numerous. All such spots were practically confined to the first and second leaves, and no other leaves became infected except on Plats III and VI, which did not receive the early spraying. The third and fourth leaves, the shoots, tendrils and clusters were protected by the spray against slight infections which came with rains of June 16th and 18th. This early spray afforded ample protection for the clusters until the blossoms fell, and it seemed to us impracticable to make another application to prevent leaf infection on any new leaves which might unfold before the blossoms had fallen.

On June 14th it became evident that the commercial lime-sulfur had caused marked foliage injury on Plat IV. For subsequent sprayings this was reduced to 1–65 dilution.

June 24th the vines were in full bloom. With the dropping of the bloom all the fruit in the vineyard was thus exposed and entirely unprotected by spray. This was an extremely critical period. Had rains of some duration come at this time, undoubtedly much fruit would have become infected. During this time weather conditions were watched very closely. Daily weather maps were consulted carefully for storm centers and their daily progress noted. We desired to delay the spraying as much as we could in order to allow for as much increase in size of the young berry as possible, but at the same time to protect the fruit with spray before a rain should come. We could easily spray our plats in a day. In spraying on a commercial scale it would usually not be practicable to wait at all after the blossoms have fallen.

Observation of the weather map for June 25th (Saturday) showed no definite storm center, but heavy rains had fallen the previous twenty-four hours in Dakota, Nebraska, and at New Orleans. The wind was from the east. Sunday the wind blew from the southeast. Monday, June 27, we did not wait for the weather map (which did not reach us until 2 P. M.), but began our spraying in the morning. At 6:45 P. M. rain began to fall. During the night .35 inches fell. Unfortunately for our experiment, the rain was accompanied by considerable wind which shook off and dried up the drops of water clinging to the vines. We did not anticipate much infection, therefore, and subsequent developments proved this to be the case.

In making this application of spray particular attention was given to coating the fruit thoroughly, but there was sufficient time in passing to cover the new growth of foliage (six to eight new leaves). At this application approximately 65 gallons of spray per acre were required Commercial lime-sulfur at a dilution of 1–65, caused considerable injury to the young fruit.

The third application of spray was made July 12th. During the two weeks since the last application the berries had increased in size rapidly and were about the size of peas at this date. Our prediction of rain was again fulfilled. Spraying was finished at 3 P. M. A shower of rain came at 3:30 P. M. In the afternoon .33 inches fell. At 6 P. M. rain began falling again and continued most of the night, with a fall of .7 inches. Again the rain was accompanied by wind, which doubtless reduced the amount of infection.

The rot from this infection appeared in the untreated plat July 22nd, and became more apparent day by day as the spots increased in size and the berries turned black. The incubation period was just ten days. Observations a few days later than this showed plainly that clusters which had a single early infected berry were nearly sure to be destroyed entirely. Rain drops, from the rains of July 12th, falling on the infected berry caused an exudation of pycnospores. These were washed down the peduncle of the cluster where the drops clung and persisted for many hours, thus allowing ample time for infection. Evaporation of such drops is surprisingly slow when the clusters are of this age and size, even though the sun shines and the wind blows.

Many growers believe they get excellent results from picking off any early infected berries in the vineyard. Growers of extensive areas of grapes say this is practicable. The authors have never tried it.

By the end of July the clusters had reached considerable size and the berries were nearly large enough to touch each other. In order to be most effective, the spray should reach all parts of the berry and especially its inner side, since it is here that most late infections occur. Accordingly, in our spraying special effort was made to get a perfect mist spray (high pressure) and to apply it directly to the clusters.

Microscopic examination of rotted berries at this date showed again, as in former years, that the fungus was developing its winter stage almost to the exclusion of the summer form.

The fourth spraying was done July 27th. Again our prediction of rain was very close. There was a shower at 5 P. M. and more rain fell in the night. July 28th was cloudy and showery. This should have proved good infection weather. As a matter of fact, however, not much infection occurred at this time since Plats I and II (the former last sprayed June 27th, the latter last sprayed July 12th) developed very little Rot. By actual count (see page 587), there were for the entire season only a small number of rotten berries on either of these plats, and much of the infection had appeared prior to this date (July 27th).

Had we fully accepted the opinion, expressed in connection with the work of 1909, that spraying may be safely omitted after the fungus

develops its winter form so abundantly, we should not have made the application on July 27th. Subsequent developments show that the application might well have been omitted. Before coming to a definite conclusion on the matter, however, we should prefer to pass through an epidemic year. This we did not have in 1910.

A careful examination of the various plats was made in late August and at picking time. From a commercial standpoint the Rot was not serious. Clipping out of Rot occasioned some delay and inconvience to packers. For some unexplained reason, the unsprayed plat (Plat IV) did not have as much rotten fruit as unsprayed vines in certain other parts of the vineyard, notwithstanding the fact that we chose this site with the purpose of obtaining the worst infected part of the vineyard. The only possible explanation seems to be that the vines were not so vigorous and made less growth, thus affording freer access for sun and wind to quickly dry out spore-laden drops of water.

To the experienced eye, careful examination of the plats showed that two sprayings (Plat I) were not sufficient to completely control the Rot. Three sprayings, one before the blossoms fell and two after (Plat II), by actual count, did not give satisfactory control.* This seems to show that our third application of spray was of no avail in 1910. In both cases the berries increased so much in size after the last spraying that new surface was exposed to slight infections of July 27th and 28th.

Owing to an error, clusters from Plat III, sprayed three times after the blossoms fell, were not counted to estimate the percentage of Rot, but from the general examination, control seemed to have been nearly perfect. This shows that bordeaux mixture properly applied and at the right time may be depended upon to prevent Black Rot infection, even though the fungus is present, as it was on the foliage in this plat. On the other hand, it does not do away with the arguments advanced in the first part of this bulletin in favor of making the early application.

In the plats designed to test the relative value of various spray mixtures, we found again that we had used nothing which gave more satisfactory results than the original grape spray — bordeaux mixture.

Scott (self-boiled) lime-sulfur (Plat V), 8–8–50, proved an easy spray to prepare and apply, but was not at all effective even in a season of mild attack. The mixture does not adhere well to the smooth surface of the grape. Unless some "sticker" can be used with it, we shall have to abandon its use for Black Rot control.

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* The difference between these two plats (see page 587) is within the range of experimental error but may be accounted for by the fact that there were many more missing vines in Plat I, thus allowing freer circulation of air.

Commercial lime-sulfur (Plat IV) at a dilution of 1–65, proved even less effective than the Scott mixture. Not only were the clusters affected directly, but because of injury to foliage, they were prevented from attaining complete development. This is strikingly shown by a comparison with vines sprayed with bordeaux:

	Average yield per vine	Average number baskets first-class fruit per vine	Average number wine grapes per vine
Lime-sulfur plat	8.8 lbs.	.88	3.6 lbs.
Bordeaux plat	14.9 "	2.88	4.2 "

Ammoniacal copper carbonate, 5–3–50 (Plat VIII), proved only slightly more effective than the lime-sulfur preparations used. No burning was apparent.

Bordeaux mixture, 4–4–50 (Plat VII), has again proved the most effective fungicide used against the Black Rot disease.

The following table was prepared by making a count of approximately 500 clusters of fruit from the various plats, the clusters taken at random and the number of rotten berries counted. We do not believe this represents the exact condition, for at certain stages of the development of Rot in the berries they are easily jarred from their pedicles and fall to the ground. Probably the difference should be greater than here indicated. The method of weighing, used in former publications on this subject, is also open to criticism, but in our opinion most nearly reveals the facts that are of importance to the producer.

Plat	No. clusters counted	No. rotten berries
1	488	91
2	502	118
3*	———	———
4	515	543
5	545	539
6	491	653
7	519	45
8	500	408

GENERAL CONCLUSIONS

The results for the two seasons, 1909 and 1910, show that with the best fungicide used by us for controlling Black Rot, the applications thought necessary for proper control of the disease have been applied at an actual loss. If an average is taken of the four years in which we have kept accurate record of loss from Black Rot (see Cornell Bulletins

* By mistake not counted.

253 and 266), we find that the advantage is decidedly in favor of spraying. The results over a period of ten years will determine whether grape spraying year after year is profitable.

Bordeaux mixture, 4–4–50, still maintains its pre-eminence as a spray for Black Rot of grapes.

The time of application of the spray is the most important single factor in the control of this disease. Spray must be on the fruit and the foliage to serve as a protection against infection, which is permitted (practically) only by rain of some duration.

The use of the weather map and of local observations, together with careful observation of the condition or stage of development of the vines, should have a place in every rational attempt to control Black Rot.

RECOMMENDATIONS

Plow as early as practicable, making a special effort to turn under all rotten clusters and leaves.

Keep all weeds and grass down.

Instruct workmen to gather any mummies left on the canes.

Do not allow basal sprouts to spread over the ground.

Spray thoroughly. The time of application will depend on the weather. Contrary to common belief, the spray should be applied before rather than after a rain. In general, the time of applications will be as follows: (1) with bordeaux mixture, 4–4–50, at the time when the second or third leaf is showing; (2) with the same mixture soon after blossoms have fallen. About two more applications will be necessary and should be made at intervals of ten days to two weeks.

The spray should be applied at a pressure of at least 100 pounds. It is better to use trailers for all the applications, but stationary nozzles may be substituted for the first spraying. After the blossoms fall the spray should be directed on the clusters and the tips of the shoots.

NOTE.— The reader's attention is called to Bulletin 293, entitled, The Black Rot Disease of Grapes. This is an extended technical treatise of the nature and cause of the disease. It will be sent to any resident of the state requesting it

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